

## IOM ANNUAL MEETING 1980

### Session 1: Transforming Influences on Health in the 1980s

#### Basic Science and Public Health

#### Joshua Lederberg

Dr. Lederberg compared health research dollars, mortality and health care costs in the United States from 1910 to 1980. A 1,000 fold exponential increase in dollars invested in health research has occurred during the interval, accelerated at the time of World War II and continued until recent years when the rate of increase decreased markedly. There has also been a steady increase in per capita health care costs. The improvement in mortality has been steady, indeed remarkably linear, in the face of increasing investment and unremitting questions about the "payoffs" to be expected from the investment in research and the much longer investments in health care.

For the future, continued improvement in mortality rate is no longer a reasonable expectation although dramatic changes may occur suddenly. It should be realized that immortality can only be approached asymptotically! Furthermore, focus on mortality alone is a distortion of the full contributions of medical science and care. Most encounters with medical technology today are devoted to improvement of health (normal function) rather than saving of life.

With regard to costs, Dr. Lederberg noted that the annual U.S. investment in health research is less than the annual increment in health services costs. The dollars devoted to research impact these care costs mainly through the adoption of halfway technologies based on imperfect scientific understanding of disease.

The long time interval between discoveries and their application to health care may attenuate public support for research. Dr. Lederberg presented, as an example, a chronology of major points in the study of DNA from Mendel and Mischer in 1865 (and the rediscovery of Mendel in 1900) through Kan's 1978 prenatal diagnosis -- by analysis of DNA -- of some hemoglobinopathies and the even more recent achievements of recombinant DNA technology (syntheses of interferon, insulin, immunoglobulins).

What accounts for the delay from lab research to clinical application? Dr. Lederberg cautioned that "easy" explanations -- such as technological impediments -- are valid but do not provide full explanations. He asks whether the scientific community has lacked aggressiveness in studying human subjects and human diseases because of taboos, both external and internal to the scientific process.

Dr. Lederberg closed his discussion with a brief analysis of what is known and what remains to be learned of human genes. He estimates that about 1 percent of human DNA is expressed as protein products. Of the estimated 100,000 proteins, only about 100 are well

understood biochemically, and perhaps 1000 are known sufficiently to have been given names. There is an enormous arena of known ignorance, much research to be done and reason to believe that much of it is indispensable to improving health.

Broad fundamental research that is exploratory in nature is a necessary parallel effort to research directed toward clinical exploitations of empirical discoveries. Many medical advances have been stumbled upon, rather than having been logically derived "from the ground up": puzzles in clinical or laboratory observations compelled an illuminating closer examination. The powerful analytic tools developed by basic research are essential to that examination. Conversely, the convergence of empirical discovery and searching analysis has often opened up new territories for basic scientific inquiry.

EXPENDITURES FOR  
BIOMEDICAL RESEARCH  
(MILLIONS OF DOLLARS)

